# Research, Development, Test, and Evaluation:
# A Defensible Process for Federal Agencies

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About the Author

Duane Blackburn has been a RDT&E program manager in the Department of Defense, the Federal Bureau of Investigation, and the National Institute of Justice. He was also a Policy Analyst and Assistant Director (for Identity Management and Homeland Security) in the White House Office of Science and Technology Policy, 2004-2011. In November 2011, he joined MITRE, from which he provides technical, strategic, and policy guidance to a number of federal programs.

# Contents

*I cannot tell you how much I sympathize with the view that important scientific projects in which we have invested in the past and would like to continue to invest in the future simply cannot be afforded under the current fiscal restraints.*
—John Holdren, Assistant to the President for Science and Technology and
Director of the White House Office of Science and Technology Policy (February 2012)[1]

# 1    A Survival Plan for the RDT&E Program Manager

Many credit science and technology with providing the foundation of this nation's prosperity[2]. Indeed, the ongoing need for federal agencies to invest in research, development, test, and evaluation (RDT&E) has been a consistent theme for the past few presidential administrations. Unhappily, federal budget deficits caused by overspending and global recessions have forced politicians and policymakers to start searching for opportunities to reign in federal spending. Inevitably, these conflicting viewpoints will converge at many levels of the federal government. That said, the people who will feel the most impact are RDT&E program managers (PM).

Through this "ready reference", MITRE aims to remediate the strain on RDT&E PMs and make it more likely that work necessary to support your agency's mission can continue to be funded. MITRE developed this model after reflecting upon the successes and failures of RDT&E programs from a variety of federal sectors over the past fifteen years.

In coming years, you, as RDT&E PMs, will be under intense pressure to prioritize and justify your budget requests as you compete for scarcer resources. Within many security-focused RDT&E agencies, this level of budget scrutiny is a foreign concept; over the past decade, the criticality of rapidly introducing new capabilities for homeland security professionals and warfighters generated an abundance of resources.

The result is a generation of federal RDT&E managers who do not now follow, or even understand, the processes required to develop defensible priorities. In the new austere budget environment, lack of experience in clearly articulating and defending your program priorities will significantly diminish your chances of receiving the fiscal and leadership support required to provide necessary capabilities to your customers.

This paper presents an adaptable RDT&E process that can serve as a foundation upon which you and your fellow federal program managers can base your prioritization and

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[1] U.S. House of Representatives, Science, Space, and Technology Committee Hearing:  *Examining Priorities and Effectiveness of the Nation's Science Policies*, February 17, 2012.

[2] "Studies indicate that 50 percent or more of the nearly sevenfold real growth the country has enjoyed since the end of World War II has been attributable to technological innovation resulting from investments in research and development." President's Council of Advisors on Science and Technology, Executive Office of the President, November. 2012, *Transformation and Opportunity: The Future of the U.S. Research Enterprise: Report to the President.* Available: http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast_future_research_enterprise_20121130.pdf

justification processes.  The process enables PMs to operate within the policies, procedures, and constraints of your parent organization.

# 2　Building Blocks for a Process That Works

## Getting Started…

…requires an understanding of the realities of RDT&E in the current, fiscally constrained environment. This includes determining who has influence over your program and the pressures that are driving their decision-making.  This knowledge will play a foundational role in your RDT&E planning process.

## Understanding Today's Realities

The quote from Dr. Holdren on the preceding page underscores the transformation that is taking place within the federal government – including its RDT&E subset.  RDT&E budgets will decrease for the foreseeable future because of the overall federal fiscal climate, and scrutiny over requests will increase as agencies are forced to map priorities against diminished budgets. PMs must therefore base their planning processes upon the fundamental tenants of successful RDT&E organizations, while operating within the policies, procedures, and constraints of their parent organization.

## Understanding Your Stakeholders, Customers, and Partners

No federal RDT&E program exists in isolation. Each provides a service to someone, using someone else's funds, and collaborates with a number of external entities. All of these entities play a direct role in your defensible RDT&E process and are discussed throughout the remainder of this paper. For ease of understanding, they are formally defined as followed for the purposes of this paper:
- *Stakeholders* provide oversight, support, and/or resources
- *Customers* receive the results of the RDT&E program's activities.[3]
- *Partners* are people with whom the RDT&E program collaborates.

Unlike most private sector companies, federal agencies can find themselves in situations in which their stakeholders and their customers are the same entity. For example, most of the time, an operational unit will view themselves as a customer of a RDT&E program, as they use technologies to support their operational missions. At other times, such as during strategy and budget development, they serve as a stakeholder in that they have roles in defining and enabling funding for the program's activities.

*The CEO of Harley Davidson once described stakeholders as "anyone who can put us out of business." Federal RDT&E PMs would be wise to think similarly. Stakeholders can include all levels of their agency management, parent Departments, the White House, Congress, the public – and even disgruntled customers!*

Beyond stakeholders and customers, RDT&E programs will have a host of partners with whom they work to fulfill their missions. Examples might include: mission partners of the entities that the program supports; interagency RDT&E activities that provide leveraging and/or collaboration opportunities; and non-federal entities (academia, national laboratories, Federally Funded Research and Development Centers (FFRDCs), and the private sector) which provide insight and perform funded RDT&E.

## Understanding Your Keys to Success

Successful RDT&E programs will be those that are closely aligned with national-level policies and agency priorities, have solid technical and project management plans, and leverage external activities as much as possible. RDT&E PMs who want their programs to survive will therefore need to:

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[3] Customers will vary based on the type of RDT&E program. A basic RDT&E program's customers would be the scientific community and/or an applied RDT&E program. An operationally focused RDT&E program's customers would be field users.

- Staff their team with technical subject matter experts (SMEs) who also have knowledge of and insight into the operational[4] contexts they are supporting
- Devote significant resources to understanding their stakeholders' priorities, their customers' technical capability gaps, the current state of technologies and their advancement trends, and their partners' activities
- Strategically select projects with the best potential for overcoming priority capability gaps, while being technically feasible and cost conscious
- Enable collaboration and sharing of technical discoveries with RDT&E partner agencies and the private sector as permitted
- Partner with their customers to successfully transition technology

The next chapter describes each of these activities, and places them within an organized process that will help you plan your RDT&E program in a defensible manner.


# 3 A Defensible RDT&E Process

For the foreseeable future, RDT&E programs will find themselves in an incredibly austere budget environment. Funding will not be available to cover all, or even most, worthwhile RDT&E activities. Indeed, even carefully planned funding allocations will likely be targets for cannibalization by other programs within the program manager's agency. That said, potential poaching can be managed by rigorously employing a defensible RDT&E process that:
- Prioritizes unmet needs based on comprehensive knowledge of what they truly are
- Takes into account technical options and their potential impacts
- Maximizes collaboration with external RDT&E activities
- Funds RDT&E projects as a result of analysis stemming from the prior three factors in this list

The figure on the next page displays a defensible RDT&E process designed to serve as the foundation for a program manger's planning. As in most RDT&E strategic planning activities, there is no clear-cut beginning and end to the process.[5] New information (from outreach activities) and capabilities (from RDT&E projects) is fed back into analysis blocks, enabling ongoing assessment of capability gaps and prioritizing of future activities.

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[4] Or, in the case of basic research programs, have knowledge of applied research activities that their successful research could transition to.
[5] This contrasts with RDT&E projects or programs, which must have clearly-defined endpoints.

Figure 1 - A defensible RDT&E process is continuous. The discussion in this paper begins with identifying customers' capability gaps.
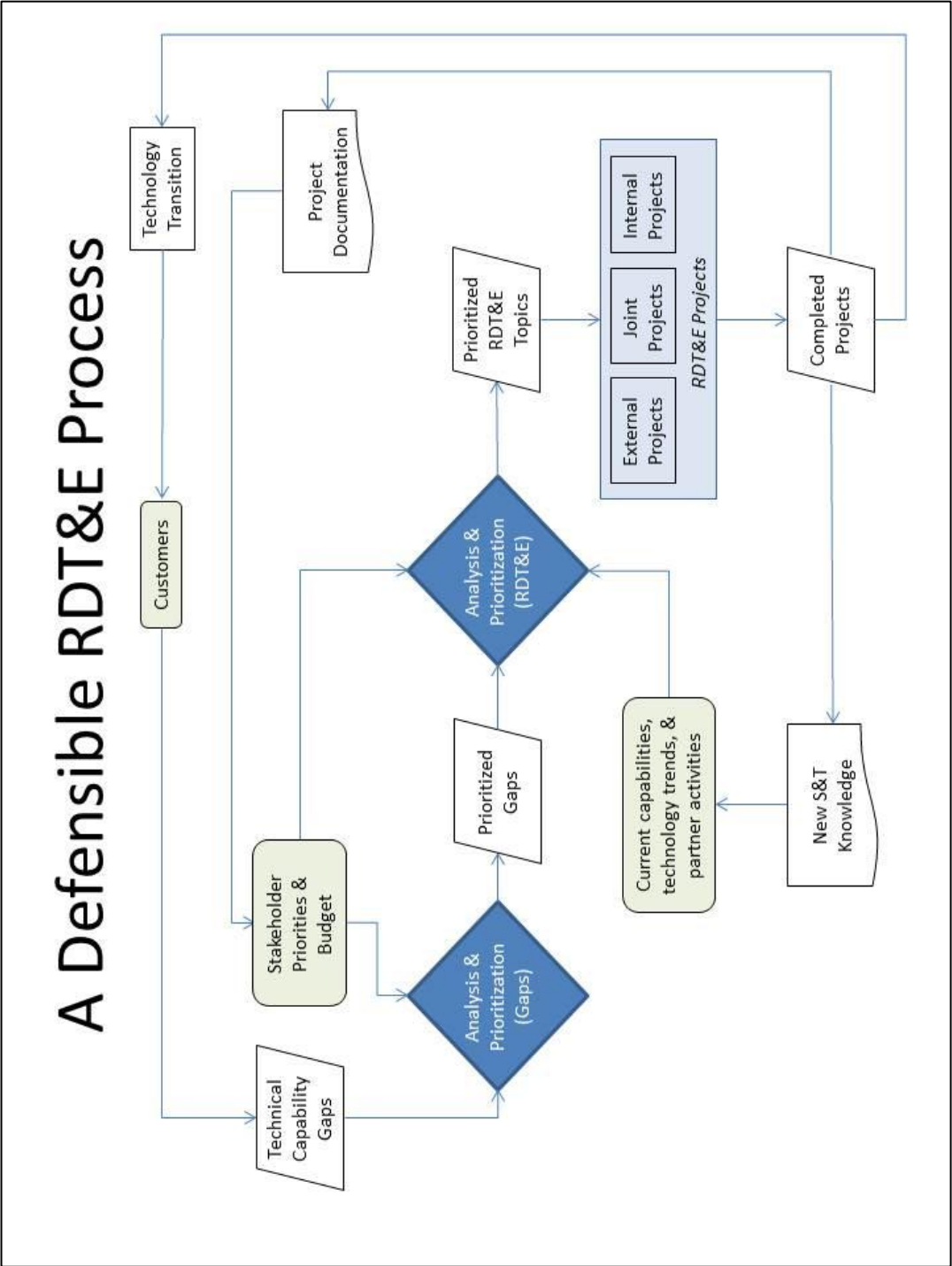
# Step 1. Determine Technical Capability Gaps

Identifying and understanding the technical capability gaps of your customers is a critical component of the RDT&E process. To be defensible, the process must continually assess customer's technical capability gaps in terms of decisions related to RDT&E activities. Additionally, customers that are operational users will likely have a limited ability to fully understand their technical capability gaps, so the program must be proactive in this step.

**The outcomes you want at this point**
- An understanding of technical capability gaps for each of your customers
- Knowledge of how each customer prioritizes their technical capability gaps



A Defensible RDT&E Process

**Key players**
- Customer-facing entities within the your agency
- Customers and their chain of command
- Your customer's partners
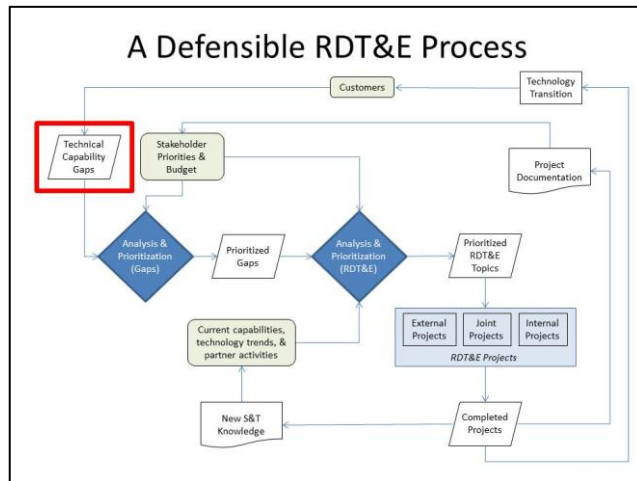
**Considerations**
- This step is predominantly an outreach function, designed to extract information on capability gaps.
- You will want to work with the customer to describe the capability gaps as specifically as possible.
- Individuals which whom the program is communicating in this process will not necessarily be familiar with RDT&E, development, or technical capabilities. Tailoring the message to gain an understanding of what is working well, what isn't working well, and what they need to be able to accomplish their job better (e.g., more efficiently, faster, or with greater results) is key.
- Customers will likely not have a realistic viewpoint on budgets, differing types of research, timelines, or the feasibility of developing the solutions they envision.

*RDT&E PMs need to take significant personal initiative for this step to be successful. PMs that rely upon their customers to formally submit a list of requirements generally receive bad information – on the rare occasions that they receive anything at all. Communication is key – you're going to have to talk with your customers a lot!*

# Step 2. Understand Stakeholder Priorities and Budget

Stakeholders fund your program and make it possible for you to develop solutions for your customers. Each stakeholder definitely wants the program to focus on overcoming priority technical capability gaps, but every stakeholder will also have their own viewpoints on prioritizing those needs—as well as having their own priorities for the program to meet.

You will need to understand stakeholders' viewpoints and budget targets so as to (a) prioritize technical capability gaps and (b) prioritize potential RDT&E projects. The RDT&E projects that the program eventually selects must correlate to stakeholder priorities or you can almost certainly expect a decrease in future resources.



A Defensible RDT&E Process

**The outcomes you want at this point**
- Stakeholder views and/or priorities on customers' capability gaps, as well as other capability gaps that they have identified
- Stakeholder views and/or priorities on RDT&E thrust areas
- Insight into budget possibilities and considerations, for example, estimating the budget available for the program across multiple fiscal years, and guidance for the program to make informed decisions on projects (e.g., best investment is to spend $x for priorities 3 and 5 rather than spend $x for priority 2)

**Key players**
- Line management within the program's agency
- The agency's parent department
- Other influential entities
    - Customers with influence over the program's stakeholders
    - For intelligence agencies, the Office of Director of National Intelligence (ODNI)
- White House
    - Office of Science and Technology Policy
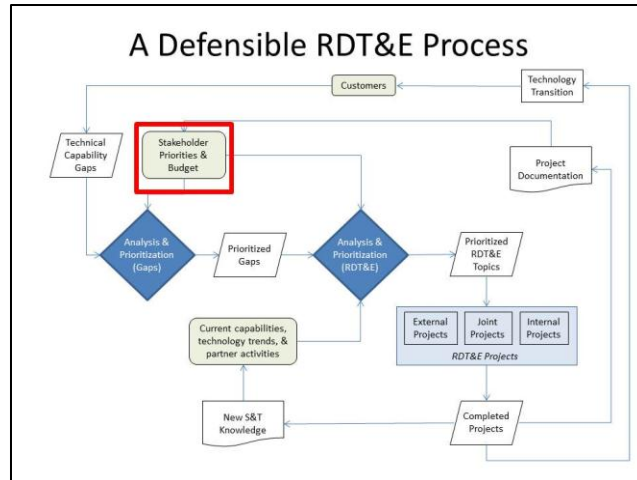
*A few years ago, RDT&E PMs needed to only worry about their closest stakeholder, but as budgets shrink senior officials will be getting more and more into what they would have previously considered "the weeds" of program management. Position your program so that it makes everyone in your line management look good to their supervisors (and oversight entities), and you'll have a greater chance of success. Hint: this will likely mean describing your program and decision processes differently at each level, as you map it to their priorities and influences.*

- o Office of Management and Budget
- o National Science and Technology Council
- o Others, depending on the nature of the program's research (e.g., National Security Staff, Domestic Policy Council, Office of National Drug Control Policy)
- Congress (authorizing/appropriating, and representative of the citizenry)

**Considerations**
- This task is predominantly an outreach function when dealing with the program's line management, but transitions to an investigative function when dealing with higher-level stakeholders. Priorities at the department and White House

*It is advisable for a program to have some form of knowledge management system in place to keep tabs on stakeholder priorities, and how they shift.*

 levels will need to be identified by reviewing directives, strategies, and speeches. It is unlikely that these documents will mention a program's potential activities directly, but they are nonetheless beneficial as they (a) point to where RDT&E budgets will be located at the macro level and (b) provide valuable references for justifying a program's requests through your line management.[6]
- Stakeholder feedback on customers' capability gaps will often not agree with what the program discovered when talking with customers directly.
- As budgets tighten, many stakeholders are going to be more risk-averse with their funding decisions than in years past. They are going to want to see a higher probability of success in their RDT&E projects.[7]
- Stakeholders are going to be keenly aware of various strategies and policies in place that they, and the program, are expected to support. Viewpoints on which strategies/policies have the most importance will vary at different levels of the stakeholder reporting chain. Alignment to these priorities will be required to obtain future resources.
- Cost-benefit ratio and alignment to a superior's priorities will weigh more heavily than keeping a customer happy by addressing their most vocal concerns.

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[6] Appendix A provides an overview of the federal government's overall RDT&E budget process. This process has a trickle-down effect as it significantly influences your stakeholders' priorities, so it is important for you to understand.
[7] These stakeholders are also going to be under pressure by the White House to maintain sufficient focus on basic research. This will have a compounding effect on other research so that their overall success rates are high.

# Step 3. Analyze and Prioritize Gaps

This is the first of two analysis and prioritization steps within the defensible RDT&E process, and it is a step that occurs within the program itself. This step would likely occur once per year, and be scheduled to support budget decisions, but would be tweaked throughout the year as more input becomes available.



The step's two inputs are the results of the two prior steps. Thus, Step 3 combines these two sets of inputs, analyzes them, and produces a prioritized list of capability gaps that the program should consider addressing. Note that the technical feasibility of gaps, the degree to which the gap has already been met by others, and the program's existing expertise will play no role whatsoever in this analysis.
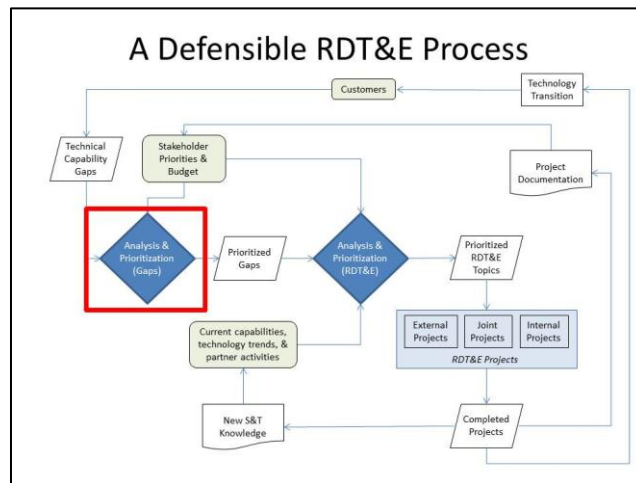
In most cases, a 1-N priority list will not be required as it will be neither necessary nor useful for later steps in the processes to distinguish between two gaps with priorities 35 and 36[8]. What is necessary is to know that they're in the range of priorities 35 and 36 rather than in the range of priorities 5 and 6. A binning process, where capabilities are placed into four or five clearly defined priority bins, is usually sufficient. Criteria should be established such that items in the top bin are only those that are of extremely high importance and the program will likely have to address. Similarly, the bottom bin will act as a discard pile into which you want to store gaps that won't merit consideration. That leaves you with two or three middle-tier bins to define so as to provide some separation and grouping of the remaining gaps.

**The outcomes you want at this point**
- Capability gaps binned into useful, prioritized, groups

**Key players**
- RDT&E program management and staff
- For some programs, it may be advantageous to also include the individual directly above the program in the agency's organization chart
- Programs with only one or two customers should consider involving them in this analysis as well. Programs with multiple customers should not do so as it can cause multiple unintended consequences, such as one customer feeling that they aren't as important to you as the others.

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[8] A 1:N listing of potential *projects* will be required (on a subset of projects) in step 5.

**Considerations**

- Participants will need to be gathered in a single location during this step as it is discussion-heavy.
- The bins should be clearly defined and understood by everyone prior to initiating analysis and prioritization.
- Discuss each capability gap individually. A designated champion will first introduce the gap (who, what, where and why), and the group will then compare it to stakeholder input and any other agency-specific criteria that is required. The group then reviews the binning definitions and discusses them until they agree in which bin the capability gap should be placed.
- It is normal for the first few analyses to take forever as everyone feels out the room and the process. The process becomes smoother and faster in subsequent analyses.
- Capability gaps that warrant significant discussion, or even disagreement, on bin placement should be placed in the lower-level bin and marked so that they're the "cream of the crop" within the lower-level bin.

*Writing out the bin definitions and placing them on an easy-to-see wall is highly recommended. The binning definitions can be altered if, after performing a few analyses, they do not seem to be yielding adequate separation.*

## Step 4. Map Current Capabilities, Technology Trends, and Partner Activities

For just about every RDT&E area, a host of prior[9] and ongoing capabilities and RDT&E projects are taking place outside the program that will be related to the capability gaps you are trying to solve. Understanding these activities, and comparing them against prioritized needs and stakeholder priorities/budget, will help you prioritize your own RDT&E topics, and will also help you identify RDT&E partnership opportunities.



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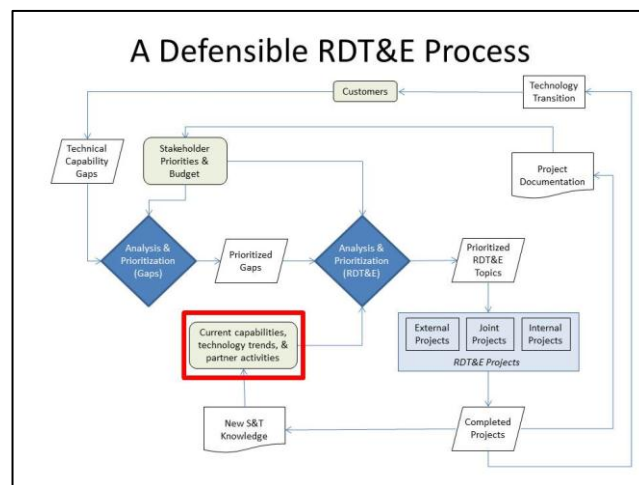
[9] An understanding of prior efforts and where they left off is just as important as knowing what projects are currently in process; this knowledge could provide insight into past difficulties and enable programs to leverage past advancements.

**The outcomes you want at this point**

- An understanding of the realm of the possible for each technical capability gap – an educated sense of current technology capabilities and future trends[10]
- An understanding of which prioritized needs are being addressed by external entities and can be leveraged, such as partnership opportunities for joint projects and stand-alone external projects that produce results the program can directly transfer to its customers.

**Key players**

- The program's technical SMEs
- Industry
- Academia
- Venture capitalists
- U.S. government RDT&E agencies
- National Laboratories and FFRDCs

*Some organizations have traditionally viewed this step as unnecessary overhead that takes funding away from RDT&E projects. The most successful organizations, however, view this step as an opportunity to capitalize on other entities' funding. This not only enables some capability gaps to be overcome with little to no internal funding, but also significantly enhances internally funded RDT&E projects' chances of success.*

**Considerations**

- This task is predominantly an outreach function, designed to extract technical information for RDT&E areas related to each capability gap. The focus should be on the higher bins of capability gaps, with lower-level bins still requiring some attention, but less specificity.
- This is not an easy task given that it requires some form of knowledge management process within the agency. This is particularly true for larger RDT&E organizations that have multiple or changing foci.
- Because of the nature of RDT&E advancement, you will need to pay ongoing attention to this step.
- A program's technical SMEs should perform this task. A proper time and budget commitment from each SME is necessary to ensure that this element is a successful part of the RDT&E process.
- Insights gained, and how they will be used, will vary based on the key players. For example, *Industry* provides insight into what is currently available, and what they foresee becoming available in the near future. *Academia* provides insight into what is coming within 5-10 years. *Venture capitalists* offer insight into related operational needs, industry-wide

*Jointly funded and managed projects are highly encouraged, as they will be looked upon favorably by agency management and stakeholders.*

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[10] Futures projections provide estimates on how technologies will evolve on their own. If a program manager estimates that the technology will advance so that it meets their needs (capability and timeline) on its own, it will not be a good candidate for funding.

commercialization plans, technology trends, and state of the industry. *Government RDT&E agencies* give insight into what they are funding, as well as how and why. This not only provides technological insight, but also helps you identify opportunities for joint projects. *National Laboratories and FFRDCs* perform RDT&E on the government's most challenging problems, and are also locations for joint projects because of the special relationships they have with the federal government.
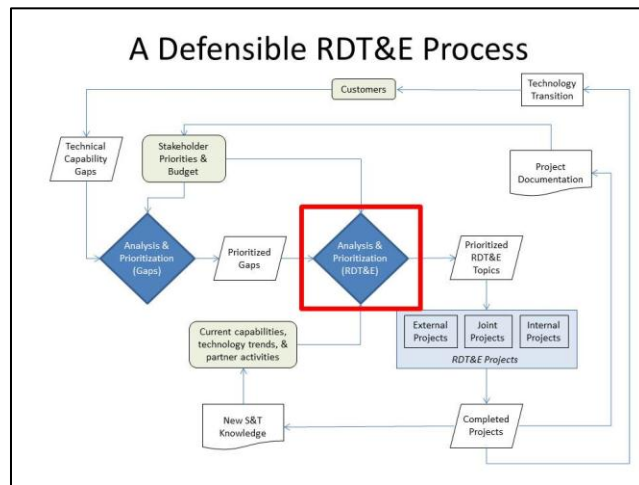
## Step 5. Analyze and Prioritize the RDT&E Project Options

This is the second of two analysis and prioritization steps within a defensible RDT&E process, and is a step that occurs within the program itself. This step would likely occur once per year, scheduled to support budget decisions, but would be tweaked throughout the year as more input becomes available.

The step's inputs are the results of the three steps discussed previously. The task here is to combine these three inputs, analyze them, and produce a prioritized list of RDT&E projects that the program should consider funding.

This analysis process also involves binning as an initial step, and uses the prioritized gaps bins from Step 3 as its starting point. Starting with the highest priority bin, each capability gap is discussed in order to determine the best approach to overcome it. "Best" in this case usually means the following, in descending order:  capitalizing on external activities, joint/partnership projects, or the program funding a



*The difficulty of this step is inversely proportional to how well you performed prior steps.  If prior steps were fully completed, this step can be easy and fun.*

project on its own. You will want to estimate timelines and resource requirements for each. If the best solution for a particular gap is untenable (i.e., not technically possible, much too costly), you would want to move it to the next lower priority bin.  After doing this for the entire bin[11], the team can compare the total resource requirements of the bin against available resources. If more resources are available, you and your team would perform a similar analysis in the next lower priority bin. When the entirety of a priority bin cannot be

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[11] Programs may also want to review the highest-rated  items in the lower level bins to determine if any of them have cheap and easy solutions and should be moved to the higher priority bin.

funded, the team would then prioritize RDT&E topics within that bin[12] to determine which subset of the bin should be selected.

**The outcomes you want at this point**
- A prioritized list of RDT&E topics that should be selected for funding

**Key players**
- RDT&E program management and staff
- For some programs, it may be advantageous to also include the individual directly above the program in the agency's organization chart
- Programs with only one or two customers could consider involving them in this analysis as well—if and only if they are technology savvy

**Considerations**
- It will be necessary to have SMEs develop course of action options/estimates as a first step, prior to the binning process.
- Much of the discussion within this analysis will be iterative, and doesn't necessarily require having all participants gathered in a single location. A final in-person review prior to finalizing the list of prioritized RDT&E topics for attention is recommended.

*Determining a best approach can require some creativity. For example, consider a NIJ "Smart Gun" program had insurmountable technical hurdles in making a firearm that recognized its authorized user. However, a combination of better body armor, retention holsters, trauma facilities, and training all combined to meet their customer's true goal (fewer officers killed by their own firearm).*

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[12] A 1:N listing of topics, based on formal criteria, will need to be developed for the projects inside this bin.

# Step 6. Executing the RDT&E Projects

At this point, the program has:
- Gathered and analyzed its customers' capability gaps, and prioritized them against stakeholder priorities and budgets
- Studied technical options and partnership opportunities
- Analyzed the priority capability gaps against technical options, and selected the "best" approach for each



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- Developed a prioritized list of RDT&E projects that the program should tackle with its available resources
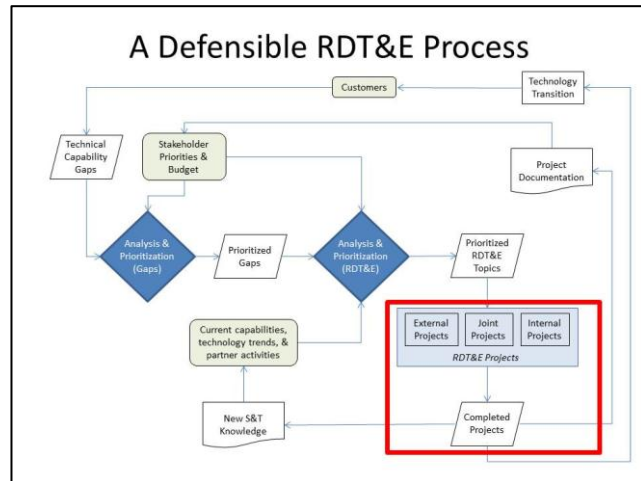
By following this approach, the program is able to defend its selections against scrutiny from outside forces. In so doing, it has also helped to protect its existing resource allocation from marauders within its agency and positioned itself with solid rationale for additional resources (those priorities that didn't make the cut). The program's work within the RDT&E process, however, is not complete.

Throughout the RDT&E project's lifecycle, new information or capabilities will become available that could cause the program to consider adjusting (up or down) allocated resources[13]. Peer review processes can have similar effects.

Once a RDT&E project has finished, your team must address three sub-steps:[14]
- Transition the technology to the customer(s). This transfer results in adjustments to those customers' technical capability gaps for future iterations of this process.
- Produce final project documents and deliver report(s) to the program's stakeholders. This is an important relationship- and prestige-building activity that will yield future benefits for the program.
- Share knowledge gained by the RDT&E project with the science and technology community[15]. Sharing has several benefits: It raises the credibility of the

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[13] Adjusting in-process RDT&E projects is problematic, and not only for the contractual issues. Function creep is a big concern, and has caused some projects to be delayed by years.

[14] Some portions of these steps will occur during the RDT&E project's lifecycle as well. For example, operationally focused RDT&E programs should involve their customers throughout the RDT&E process and have a solid plan to overcome the "valley of death."

[15] Ownership of intellectual property will also have to be determined.

program within the science and technology community as they see its contributions advancing the state of the art. It also enables others to study and leverage the program's work by facilitating peer review of program activities, which is an important aspect of a mature RDT&E process. In addition, it enables others to further advance and/or mature the program's RDT&E gains.  Finally, it strengthens the professional network of the program, making future iterations of the RDT&E process more collaborative and successful.



*Post-project communication and outreach is an important, though often forgotten, element of successful RDT&E projects.  Non-publicized advancements will always die.  Well-known advancements will take on their own life, providing you and your customers even more benefits in the future.*

# 4    Conclusion

This paper presents a generic RDT&E process for federal RDT&E managers to build their defensible processes upon, while operating within the policies, procedures, and constraints of their parent organization. That said, this process is not specific enough, nor is it aligned with every policy/procedure of a program's parent organization, to be implemented without additional planning.

Programs planning to implement the process described in this paper should rely upon a small team to work through each step in the process and determine correlations, overlaps, and gaps with their parent organization's existing policies/procedures. The team should then perform similar analyses for each step against the program's own policies/procedures, and adjust them as needed so that they meet their program's ultimate goal:  implementing a defensible process for determining their RDT&E activities.

# Appendix A    The Federal RDT&E Budget and How it is Established

## A1.    Quick Look at the Budgeting Process

This paper has focused on the process that a federal RDT&E program manager could follow so that their budget decisions are sound and defensible. Although this is a critical step in the federal government's overall RDT&E budget process, it is the last of several steps. A high-level understanding of the overall process will not only provide insights to better understand the stakeholder influences described in the body of the paper, but will also enable you to support earlier stages of the budget development process. This, in turn, increases the chances that your priorities will also be viewed as priorities by your line management and stakeholders.

The federal government's RDT&E budget process is linear, but three budgets are always being addressed concurrently. For example, in early 2013, the federal government is concurrently (a) executing the FY13 budget; (b) putting the finishing touches on the administration's FY14 budget request to Congress; and (c) determining priorities and approaches for the FY15 budget.

Figure 2 depicts the federal fiscal year, with key milestones for each of the three budgets being worked. The remainder of this appendix will walk through the 3-year process of the federal government's RDT&E budget development and implementation.

**Figure 2- RDT&E Development Timelines**
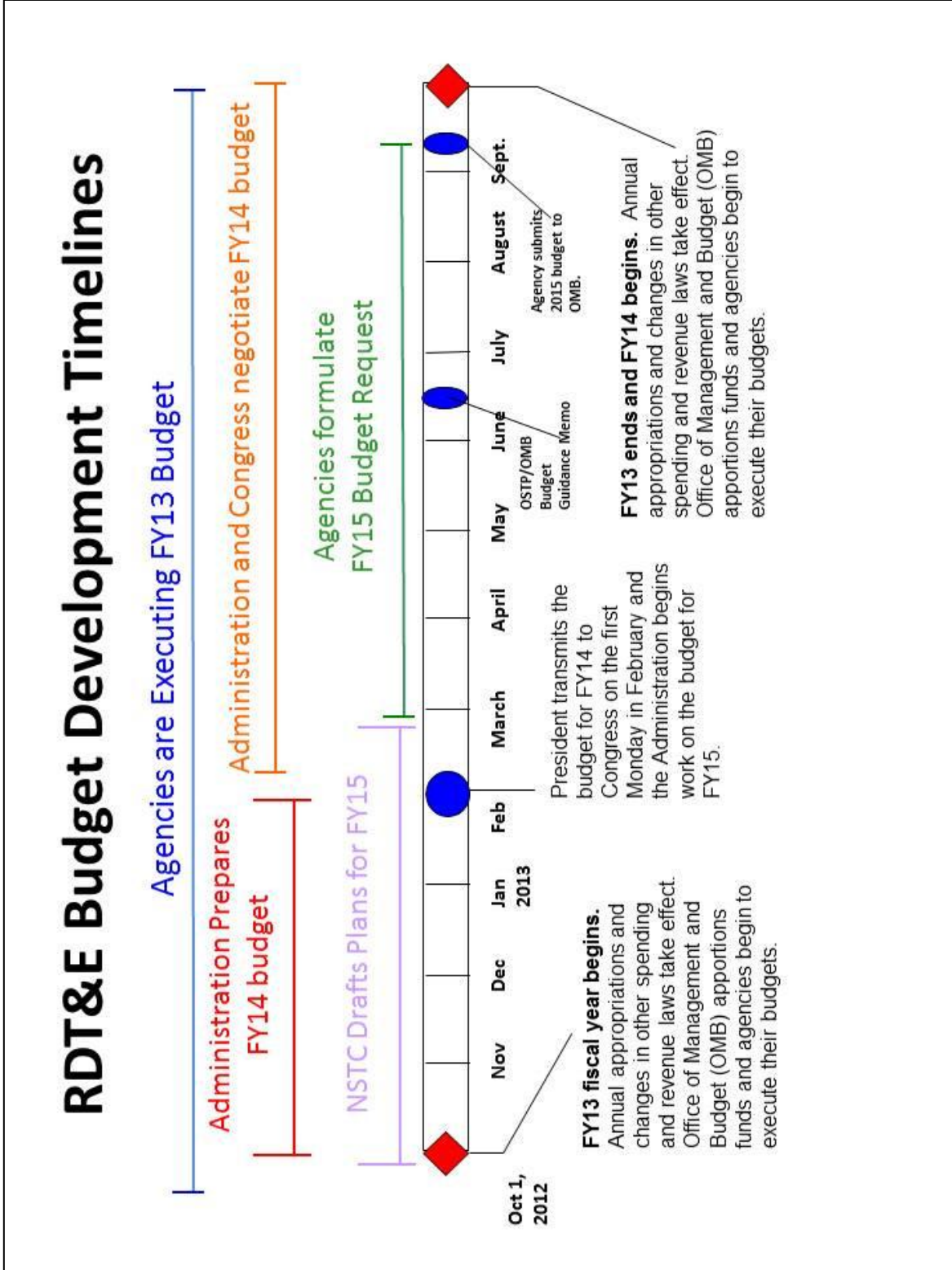
## A2.    How High-Level Priorities Are Determined

President Clinton established the National Science and Technology Council (NSTC) via Executive Order on November 23, 1993 to coordinate science and technology policy across the federal government[16]. The NSTC is managed by the Office of Science and Technology Policy (OSTP), which is a part of the Executive Office of the President[17]. A primary objective of the NSTC is to establish clear national goals for federal science and technology investments across virtually all the mission areas of the executive branch. This NSTC task is where the federal government's RDT&E budget planning begins.

Within the NSTC, policies and priorities are typically determined at the Committee level, whose membership is the highest-level S&T executive within each federal department. The NSTC has historically had four subordinate Committees, with a fifth (STEM Education) being added in the Obama administration:

- Committee on Environment, Natural Resources, and Sustainability
- Committee on Homeland and National Security
- Committee on Science
- Committee on Technology

Each of these Committees reviews presidential direction and their own agencies' needs to determine which S&T topics should be priorities for interagency coordination. They will then formally charter subordinate entities, typically a *Subcommittee,*[18] for each topic. Subcommittees consist of a mixture of federal subject matter experts (SMEs) and policy officials, and are tasked with (a) determining subject-specific priorities[19], (b) developing an interagency RDT&E plan to overcome those priorities, and then (c) ensuring agency budgets and interagency collaboration is in-place to meet the plan.

It is vitally important for you, as an RDT&E program manager, to have knowledge of these activities if you have projects within NSTC subject areas. Your stakeholders are going to be pressured to support these initiatives, which raise the profile of related RDT&E projects. This, in turn, makes it easier for your team to justify RDT&E expenditures.

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[16] "Chaired by the President, the membership of the NSTC is made up of the Vice President, the Director of the Office of Science and Technology Policy, Cabinet Secretaries and Agency Heads with significant science and technology responsibilities, and other White House officials."  National Science and Technology Council." *The White House*. Retrieved 14 Dec. 2012: http://www.whitehouse.gov/administration/eop/ostp/nstc.

[17] *The Executive Office of the President* is the formal name for what is typically referred to as the *White House.*

[18] *Subcommittees* are chartered for topics that will require multiple years of coordination, *Interagency Working Groups* for single-year topics, and *Task Forces* for 6-month (or less) coordination.

[19] Subcommittees will occasionally publish these priorities at http://www.whitehouse.gov/administration/eop/ostp/nstc/docsreports

## A3.　How Agencies Make Budget Requests

Agencies perform the vast majority of their budget planning well before funding is appropriated and made available to RDT&E program managers. This work will typically[20] begin in the first quarter of a calendar year and concludes with the agency submitting its budget request in September to the Office of Management and Budget (OMB) for the fiscal year that starts 12 months later. For example, in September of 2013, the agency will submit its budget request for fiscal year 2015 (which will begin on 1 October 2014).

During this period, OSTP and OMB will issue its RDT&E Budget Guidance Memorandum[21], which provides a short list of topics that agencies need to emphasize in their budget requests. These items can be viewed as even higher-level priorities than those that were determined by the NSTC, and are typically a mixture of what the NSTC feels is most critical and the president's personal priorities.

## A4.　Development of the President's Budget Request

After agencies submit their budget requests, OMB begins a multi-month process of reviewing the requests and developing the President's budget request to Congress. OSTP participates in this process, and compares agency RDT&E plans and budgets to the NSTC-developed roadmaps and the Budget Guidance Memorandum. Multiple iterations of budget plans are developed, as OMB works to adjust budgets to fit under target dollar amounts and OSTP/OMB work to ensure that priority RDT&E projects are adequately funded.

Toward the end of the process, OMB will provide agencies a nearly final version of their budget for their review.[22]  Agencies will have a couple of days to review the budget and prepare appeals back to OMB if they feel the budget needs to be adjusted. OMB will then finalize the budget and work with agencies to develop budget books and supporting documentation so that the President can transmit his budget request to Congress on the first Monday of February.

## A5.　How Appropriations Are Decided

After receiving the President's Budget Request, Congress initiates actions on their budget authorization and appropriations processes. The basics of this process can be found in any civics textbook and are therefore not discussed here. Throughout this process, agency heads are required to testify before a number of Committees on both the House and Senate side, as well as answer a number of Questions for the Record (QFR)[23] about their budget requests. The EOP and Congress negotiate extensively throughout this process.

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[20] DoD processes are so complex that this planning starts much earlier.
[21] These memoranda are available from http://www.whitehouse.gov/administration/eop/ostp/rdbudgets
[22] This is referred to as *pass-back.*
[23] Agency answers to QFRs are reviewed and approved by OSTP and OMB prior to submission to Congress.

## A6.    The Budget Execution Process

Once Congress has passed a budget, and it is signed into law by the President, appropriated funds begin to trickle down through agencies until they are available for your use as an RDT&E program manager. As appropriated funds are typically different from what the President requested, and certainly different from what you and your agency originally requested, budget planning occurs throughout this trickle down process as well.

## A7.    Understanding Factors that Influence Budget Decisions

The high-level RDT&E budget process impacts federal RDT&E program managers by significantly influencing your stakeholders and line management as budgets are developed and adjusted. Understanding these influences allows you to strategically shape, discuss, and justify your own budget requests.

# Acknowledgments